

# Simplified back-propagation for fibre nonlinearity compensation employing multi-band OFDM signals

L. M. Pessoa · H. M. Salgado · I. Darwazeh

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**Abstract** In this paper we investigate the efficacy of applying the coupled field back-propagation algorithm as a post-compensation method for nonlinearity mitigation in a coherently detected fibre optic long-haul system using multi-band orthogonal frequency division multiplexed signals. Specifically, we analyze the impact of varying the band-spacing and the number of bands. We find that its efficacy is higher for largely spaced bands and a small number of bands. Additionally, we propose a method to include the Four Wave Mixing compensating term within the coupled field method to provide simplified means of multichannel compensation. We conclude that this method is more efficient in improving the performance especially for small band spacings. The coupled field method proves to be an interesting choice for the implementation of receiver-based real-time digital signal processing.

**Keywords** Multi-band OFDM · Back-propagation · Four wave mixing

## 1 Introduction

The interplay between fibre chromatic dispersion, intra-channel nonlinearities and amplifier noise is determinant in limiting the maximum capacity of a fibre-optic long haul transmission. However, when considering the transition from single channel to multichannel (Wavelength Division Multiplexed—WDM) systems, attention must be paid also to nonlinear inter-channel

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L. M. Pessoa (✉) · H. M. Salgado  
INESC TEC (formerly INESC Porto) and Faculty of Engineering, University of Porto,  
4200-465 Porto, Portugal  
e-mail: luis.m.pessoa@inescporto.pt

H. M. Salgado  
e-mail: hsalgado@inescporto.pt

I. Darwazeh  
Department of Electronic and Electrical Engineering, University College London, Torrington Place,  
WC1E 7JE London, UK  
e-mail: i.darwazeh@ee.ucl.ac.uk